PSYCHE

A JOURNAL OF ENTOMOLOGY

ESTABLISHED IN 1874

Vol. 62 March, 1955 No. 1

TABLE OF CONTENTS

Healed Wounds and Galls on Fossil Leaves from the Wilcox Deposits (Eocene) of Western Tennessee. *H. K. Brooks* . 1
The Females of *Enallagma laterale* Morse and *recurvatum* Davis (Odonata: Coenagrionidae). *R. H. Gibbs, Jr.* 10
A New Species of Ant Belonging to the *Pheidole pilifera* Complex (Hymenoptera: Formicidae). *R. E. Gregg* 19
Species of the *Amata* (*Syntomis*) *pfeifferae* Group (Lepidoptera: Ctenuchidae). *N. S. Obraztsov* 29
Brephidium barbouri Clench a Synonym of *Brephidium exilis isophthalma* (Herrich-Schaffer) (Lepidoptera: Lycaenidae). *N. W. Gillham* 34
Tylothrips bruesi, a New Thysanopteron from Florida. *J. D. Hood* 35
An Eocene Bittacus (Mecoptera). *F. M. Carpenter* 39
The Southwestern Research Station of The American Museum of Natural History 41
An Odonate Fossil Wing from the Oligocene of Oregon. *Lt. Col. F. C. Fraser, I.M.S., Retd.* 42

CAMBRIDGE ENTOMOLOGICAL CLUB

OFFICERS FOR 1954-55

President . . . . . E. O. WILSON
Vice-President . . . . . T. EISNER
Secretary . . . . . N. W. GILHAM
Treasurer . . . . . F. M. CARPENTER
Executive Committee . . . W. L. BROWN, JR.
. . . S. K. HARRIS

EDITORIAL BOARD OF PSYCHE

F. M. CARPENTER — EDITOR
C. T. BRUES
P. J. DARLINGTON, JR.
J. BEQUAERT

PSYCHE is published quarterly, the issues appearing in March, June, September, and December. Subscription price, per year, payable in advance: $3.00 to subscribers in the United States and Canada; other subscriptions $3.35. Single copies, 85 cents.

Cheques and remittances should be addressed to Treasurer, Cambridge Entomological Club, Biological Laboratories, Harvard University, Cambridge, Mass.

Orders for back volumes, missing numbers, notices of change of address, etc., should be sent to the Editorial Office of Psyche, Biological Laboratories, Harvard University, Cambridge, Mass.

IMPORTANT NOTICE TO CONTRIBUTORS

Manuscripts intended for publication, books intended for review, and other editorial matter, should be addressed to Professor F. M. Carpenter, Biological Laboratories, Harvard University, Cambridge, Mass.

Authors contributing articles over 8 printed pages in length will be required to bear a part of the extra expense, for additional pages. This expense will be that of typesetting only, which is about $3.00 per page. The actual cost of preparing cuts for all illustrations must be borne by contributors; the expense for full page plates from line drawings is approximately $8.00 each, and for full page half-tones, $10.00 each; smaller sizes in proportion.

AUTHOR'S SEPARATES

Reprints of articles may be secured by authors, if they are ordered before, or at the time proofs are received for corrections. The cost of these will be furnished by the Editor on application.

The Dec., 1954, PSYCHE (Vol. 61, No. 4) was mailed January 26, 1955

EATON PRESS INC., WATERTOWN, MASS.

PSYCHE

Vol. 62 March, 1955 No. 1

HEALED WOUNDS AND GALLS ON FOSSIL LEAVES FROM THE WILCOX DEPOSITS (EOCENE) OF WESTERN TENNESSEE

By H. K. Brooks

University of Cincinnati, Cincinnati, Ohio

Introduction

The specimens described herein are not the first evidence of insects to be reported from the Eocene deposits of Western Tennessee and the adjoining states of Alabama, Mississippi, Arkansas and Kentucky. Features produced by the activities of insects on fossil leaves have been described and figured by Berry (1916, 1928, 1930, and 1931). Collins (1925, p. 406) observes that "Insects must have been more or less plentiful at this time, as we find such evidence of them as fossil insect galls and caddis fly tubes, while leaves occasionally exhibit holes, galleries and irregular margins which are due in all probability to insect ravages."

The alleged evidence of insect activities, a termite wing described by Collins (1925), a wing of a large ponerine ant by Carpenter (1929) and the elytra of three species of beetles by Wickham (1929) are the only traces of arthropods reported from the Wilcox deposits of Tennessee and adjoining states. These deposits have yielded one of the best preserved early Tertiary floras of North America and it seems anomalous that arthropods should have left such a meager record.

The caddis fly cases constructed of fragments of leaves are well preserved and have been well illustrated by Berry

(1928). With the exception of the galls, the other alleged insect-produced features have either been misinterpreted or the features are of questionable significance.

Collection and Occurrence

The specimens described below were collected by the late Dr. R. Lee Collins. They are from a clay lens in the Holly Springs formation exposed in a clay pit immediately southwest of Puryear, Henry County, Tennessee. This lens of kaolinitic clay contains an abundance of well preserved angiosperm leaves. Berry (1916 and 1930) studied the flora and determined the age of the deposit to be lower Eocene.

Berry (1928, p. 3) interpreted the paleoecology of these deposits of crossbedded sands and lenses of plant bearing clays to be nonmarine. "The general environmental picture of this area during the time of deposition . . ., is of a low, abundantly forested, warm temperate coast, with bayou-like stream distributaries emptying into lagoons ponded behind extensive barrier beaches, beyond which the gulf waters were extremely shallow, and not typically marine for a considerable distance."

Evidence of Leaf-cutting Bees

In 1916, Berry (p. 33, pl. 107, fig. 5) figured a leaf of *Icacorea prepaniculata* from Puryear, Tennessee, which he states is "badly riddled in a manner suggesting the work of leaf-cutting bees." The figured specimen has over sixty small, irregular holes. This is not the type of injury produced by recent megachilid bees and therefore Berry's alternate suggestion that the holes "are due to a brood of leaf-eating caterpillars" is a better guess. Later, Berry (1930, pl. 48, fig. 33) figured a leaflet of *Cassia fayettensis* from the same locality with a very irregular saw-toothed margin. Small notches variable in size but all less than 2 mm. across have been cut-out all around its margin. The explanation of the figure states that it is "A leaflet showing an insect-cut margin," and it is cited (Berry, 1931, p. 302) as "a specimen which has been cut in a manner which may indicate the work of some lower Eocene leaf-cutting bee." In the same paper, a leaf of *Icacorea*

perpaniculata from Graves County, Kentucky, with embayments cut into its margins, 6 to 9 mm. across, is figured and discussed. The notches are crudely semicircular and are variable in outline and in size. Berry admits the dubious nature of these injuries and suggests as an alternative that the cuts may have been made by caddis fly larvae for the construction of cases.

These examples are all suggestive of the work of leaf-eating insects. The last specimen cited may have been cut by a primitive leaf-cutting bee, the work of which appears cruder than that of the modern Megachilidae but can hardly be regarded as conclusive evidence of the presence of megachilid bees in the Eocene forest of Tennessee and adjoining states.

A bee-cut *Nectandra pseudocoriacea* leaf, more authentic than those described by Berry, was collected by R. Lee Collins at Puryear, Tennessee. The leaf has four semicircular pieces, 5 to 6 mm. in diameter, cut from one of its edges (pl. 1, fig. 1 and 1a). The darkened borders of the wounds appear to be lignitized remains of scar tissue. Recent female megachilid bees inflict similar injuries in cutting pieces of leaves for the construction of nests. Semicircular pieces are cut for the construction of the sides and circular pieces for partitions. In contrast, damages to leaves produced by phytophagous insects are irregular in shape. The scar tissue proves that the leaf remained on the tree for some time after it was injured and could not have been cut by a caddis fly larva for pieces of leaves to construct a case (pl. 1, fig. 6) as Berry suggested (1931, p. 303). The uniformity of the shape and size of the injuries and the presence of the scar tissue is credible evidence that the fossil leaf was damaged by a leaf-cutting bee.

No fossil Megachilidae have been reported from rocks older than the Oligocene deposits of Florissant, Colorado (Cockerell, 1908). The deposit has also yielded a leaf with semicircular notches cut into its margin which Cockerell (1910, p. 429) states is evidence that the habit of cutting out pieces of leaves for building nests was as highly developed by the megachilid bees during the Oligocene as

it is at present. On the basis of the above described insect-cut leaf, the range of the Megachilidae is provisionally extended to the Eocene.

Leaves Damaged by Phytophagous Insects

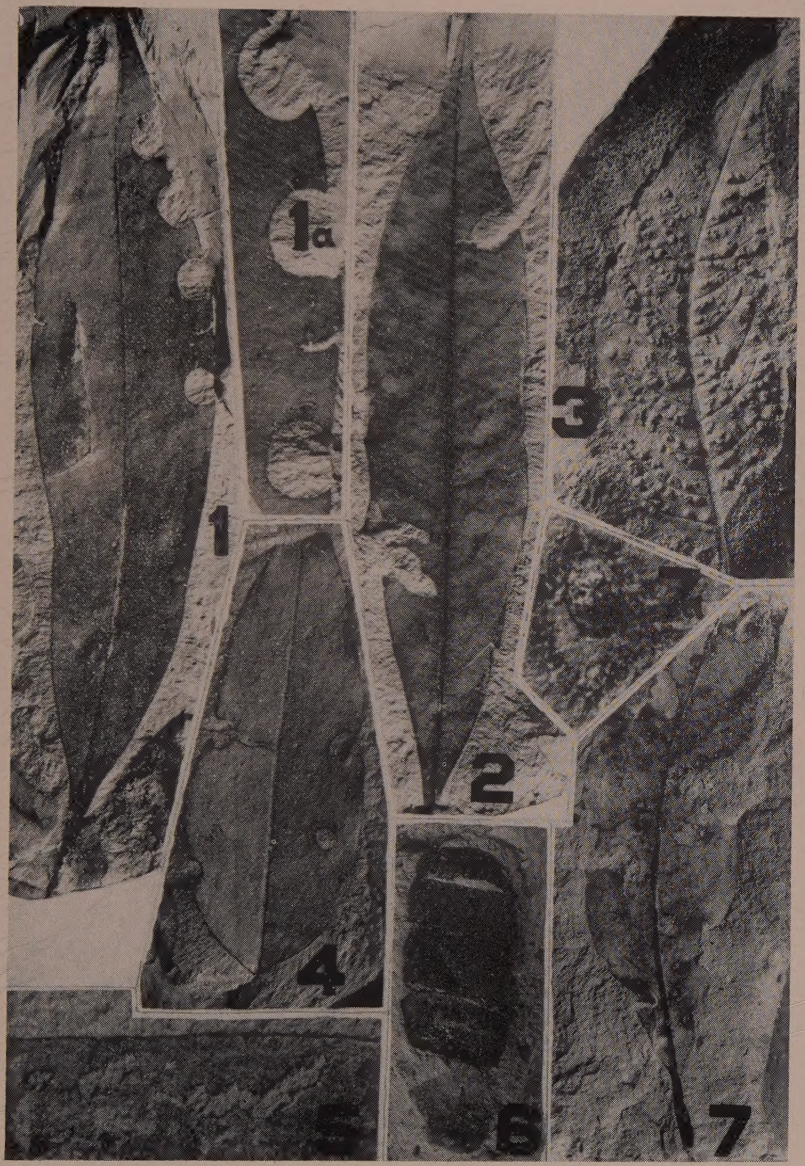
Nearly half of the extant species of insects are phytophagous (Brues, 1946, p. 90) and phytophagy is generally assumed to be the primitive diet. It is perplexing, therefore, that no example of the remains of fossil plants from the Paleozoic and lower and middle Mesozoic have been reported exhibiting healed wounds that could have been caused by insects. However, most Recent defoliators feed on angiosperms and healed damages are rather common on fossil angiosperm leaves from the Cretaceous and Tertiary.

A variety of healed injuries which appear to be due to phytophagous insects are shown on leaves figured on plate 1, fig. 2, fig. 4, fig. 5, and fig. 7. Determination of the culprits responsible for the different types of damage is impossible.

The "galleries" in the angiosperm leaves from the Wilcox deposits mentioned and figured by Berry (1916, p. 32; pl. 23, fig. 3; pl. 31, fig. 1 and fig. 3; pl. 38, fig. 4; pl. 39, and pl. 92) and which were later referred to by Collins (1925, p. 406) are not the same as the meandering, elongate, narrow wounds surrounded by scar tissue on the portion of a *Proteoides wilcoxensis* leaf shown enlarged in fig. 5.

Explanation of Plate 1

Figure 1. A fossil leaf, *Nectandra pseudocoriacea* Berry, from the Wilcox deposits of Puryear, Tennessee, bearing injuries inflicted by megachilid bees. Figure 1a. A portion of the above described leaf enlarged to twice natural size to show the scar tissue surrounding the injuries. Figure 2. A fossil leaf, *Nectandra pseudocoriacea* Berry, bearing healed wounds probably inflicted by defoliating phytophagous insects. Figure 3. A fossil leaf, *Cupanites formosus* Berry, bearing simple pouch galls. Figure 4. A fossil leaflet, *Cassia sp.*, bearing healed wounds. Figure 5. A portion of a fossil leaf, *Proteoides wilcoxensis* Berry, enlarged four times to show healed meandering wounds. Figure 6. Fossil caddis fly case, *Folindusia wilcoxiana* Berry, found in association with the other figured specimens. Figure 7. A fossil leaf, *Nectandra pseudocoriacea* Berry, badly damaged by leaf-eating insects and bearing 11 galls. Figure 7a. A portion of figure 7 enlarged 10 times to show one of the galls.



BROOKS — FOSSIL GALLS

These wounds were inflicted by some creature crawling on the surface of the leaf and not by a mining insect, such as the larvae of some moths and saw flies which tunnel through mesophyll.

This author has seen nothing suggestive of the activity of leaf mining insects on fossil leaves. The "galleries" referred to appear to be products of preservation as they consist of low ridges of uniform width which run across the leaves irrespective of the veins and the midribs.

GALLS

Traumatic plant growths comparable to Recent galls are uncommon on the remains of plants from Tertiary. Fossil galls have been figured from the Wilcox deposits of Tennessee by Berry (1916, p. 33, pl. 56, fig. 2, and pl. 111, fig. 1), mentioned by Collins (1925, p. 406) and again by Berry (1931, p. 301). Scudder (1886, p. 98) mentions cynipid galls from the Oligocene deposits of Florissant, Colorado and a gall was figured, discussed and named by Cockerell (1908, p. 66, pl. 5, fig. 7) and Brues (1910, p. 14, fig. 7). The Oligocene galls were later discussed by Kinsey (1919, p. 44-49) and he states that they are synonyms and definitely are not cynipid galls. Miocene galls from Douglas County, Washington, have been described by Hoffman (1932, p. 341-342, fig. 1) and compared to Recent cynipid and itonid galls. Brues (1946, p. 171) mentions that galls have been observed on Cretaceous leaves but does not document his statement.

The leaf of *Cupanites formosus* illustrated on plate 1, fig. 3 from Puryear, Tennessee, has many malformations between the veins and veinlets which closely resemble Recent simple pouch galls. The individual irregular pouches average about 1 mm. in diameter and vary from about one-half to twice this size. The individual pouches are simple invaginations from the ventral side of the leaf. Similar Recent homeomorphic abnormalities are commonly produced on leaves by gall mites (Eriophyidae), aphids (Aphidae), jumping plant lice (Chermidae=Psyllidae) and several other types of lowly arthropods. Crinkling of leaves which bears some resemblance to the malformations on the fossil leaf are sometimes produced by fungal infections.

Not only does the leaf of *Nectandra pseudocoriacea* figured on plate 1, fig. 7, bear the results of the activity of some leaf-eating organism, presumably an insect, but the remaining part of the leaf bears eleven well preserved "cone" galls (fig. 7a). The structures are mammilliform and seem to be separated from the leaf by a constriction at the point of attachment. They are elliptical at the base, 1 mm. by 0.8 mm., and taper to a blunt apex about 0.4 mm. above the surface of the leaf. Immediately surrounding the galls, the leaves are darkened. The darkened areas probably reflect sclerotized leaf tissue in the vicinity of the galls as the coloration is due to a greater amount of lignitized leaf residue.

These "cone" galls are comparable in size and general shape to some Recent galls induced to develop on leaves by gall mites (Eriophyidae), plant lice (Phylloxeridae) and especially by gall midges (Cecidomyiidae=Itonididae) and by gall wasps (Cynipidae). The sclerotized leaf tissue surrounding the galls is suggestive of Recent "leaf spot galls" produced by the gall midge, *Cecidomyia ocellaris* on maple leaves (Felt, 1940, fig. 258).

Neither of the alleged insect galls described and figured by Berry (1916, pl. 111, fig. 1, and pl. 56, fig. 2) is similar to the structures described above. One consists of small, deep, conical depressions on the impression of a leaf and the other is a compression of a petiole gall. Both figured specimens seem to bear authentic galls.

Though binomial names have been proposed by Cockerell (1908) and Brues (1910) for fossil galls, it is believed that no useful purpose is served by naming such objects.

Gall forming arthropods are small and fragile and thus there is an extremely meager fossil record of their remains. The reported stratigraphic ranges of the families mentioned above are as follows:

Class Arachnida

Order Acarina, Family Eriophyidae, no fossils

Class Insecta

Order Hemiptera, Family Phylloxeridae, no fossils

Family Chermidae, Oligocene to Recent (Handlirsch, 1921).

Family Aphidae, Cretaceous (?) to Recent (Essig, 1937).

Order Diptera, Family Cecidomyiidae, Eocene? to Recent (Handlirsch, 1921).

Order Hymenoptera, Family Cynipidae, Cretaceous (?) to Recent (Kinsey, 1937).

ACKNOWLEDGEMENTS

Dr. Frank M. Carpenter kindly provided information on the known stratigraphic ranges of the families mentioned. Dr. Roland W. Brown identified the fossil leaves and made several helpful suggestions and corrections on a preliminary copy of this paper.

It is hoped that this paper will be a tribute to the late Dr. R. Lee Collins who recognized the significance of these fossils. They have been placed in the collections of the United States National Museum where many other excellent specimens of fossil plants from the Wilcox deposit collected by Dr. Collins have previously been placed.

LITERATURE CITED

BERRY, E. W.

1916. The Lower Eocene floras of southeastern North America: U.S. Geol. Survey, Prof. Pap. 91.

1928. A new type of caddis case from the Lower Eocene of Tennessee: U.S. Nat. Mus. Proc., **71**: art. 14.

1930. Revision of the Lower Eocene Wilcox flora of the southeastern states, with descriptions of new species from Tennessee and Kentucky: U.S. Geol. Survey, Prof. Pap. 156.

1931. An insect-cut leaf from the Lower Eocene: Am. Jour. Sci., **21**: 301-304.

BRUES, C. T.

1910. The parasitic Hymenoptera of the Tertiary of Florissant, Colorado: Bull. Mus. Comp. Zool., **54**: 1-125.

1946. Insect dietary: Harvard Univ. Press, Cambridge, Mass.

CARPENTER, F. M.

1929. A fossil ant from the Lower Eocene (Wilcox) of Tennessee: Jour. Wash. Acad. Sci., **19**: 300-301.

COCKERELL, T. D. A.

1908. Fossil insects from Florissant, Colorado: Am. Mus. Nat. Hist., **24**: 59-69.

1908. A fossil leaf-cutting bee (*Megachile praedicta*, Florissant, Colo.): Canadian Entomologist, **40**: 31-32.

1910. A Teritiary leaf-cutting bee: Nature, **82**: 429.

Collins, R. L.

1925. A Lower Eocene termite from Tennessee: Am. Jour. Sci., ser. 5, **9**: 406-410.

Essig, E. O.

1937. Insects and Arachnids from Canadian Amber: Univ. Toronto Studies, Geol. Ser., **40**:18.

Felt, E. P

1940. Plant galls and gall makers: Comstock Pub. Co., Ithaca, N.Y.

Handlirsch, A.

1921. Palaeontologie: In Schröder's Handbuch der Entomologie, **3**: 206-213; 274-283.

Hoffman, A.

1932. Miocene insect gall impressions: Bot. Gazette, **93**: 341-342.

Kinsey, A. C.

1919. Fossil Cynipidae: Psyche, **26**: 44-49.

1937. Insects and Arachnids from Canadian Amber: Univ. Toronto Studies, Geol. Ser., **40**: 21.

Scudder, S. H.

1886. Systematic review of fossil insects: U.S. Geol. Survey Bull., **31**.

Wickham, H. F.

1929. Coleoptera from the Lower Eocene (Wilcox) clays: Jour. Washington Acad. Sci., **19**: 149-150.

THE FEMALES OF *ENALLAGMA LATERALE* MORSE AND *RECURVATUM* DAVIS (ODONATA: COENAGRIONIDAE)

By Robert H. Gibbs, Jr.

Department of Conservation
Cornell University, Ithaca, New York

Of the 23 northeastern members of the genus *Enallagma*, the females of *piscinarium*, *laterale*, and *recurvatum* have not been described. *E. piscinarium* is apparently known only from the type male. Although males of *laterale* have been taken in several localities, the female remains unrecorded. The female of *recurvatum* may have been collected, but references to it are quite misleading. In the original description of the species by Davis (1913) the female is supposedly described, but the description is quite inadequate and not diagnostic. Byers, in his key (1927), does not distinguish it from *E. hageni* other than by its comparative rarity. Garman (1927) stated that "all supposed females thus far examined have proved to belong to other species."

Systematic collecting on Cape Cod, Massachusetts, has resulted in the finding of tandem pairs of both *laterale* and *recurvatum*. In addition, Thomas W. Donnelly has allowed me to examine some collections sent to him by Mr. Roy Latham from Riverhead, Long Island, New York, which contained two females of *recurvatum* and one of *laterale*. The following descriptions are based on these Cape Cod and Long Island specimens.

For suggestions during the preparation of this manuscript, I wish to express appreciation to E. M. Walker, L. K. Gloyd, M. J. Westfall, Jr., T. W. Donnelly, H. E. Evans, and J. G. Franclemont.

Enallagma laterale Morse. Female

Psyche 7: 274. 1895

Color: Olivaceous, washed with light blue, and black.

Head: Dorsum black; pale frontal margin reaching bases

of antennae; postocular spots elongate, comma-shaped, connected by a narrow, pale occipital bar, not quite reaching the ocular margins; face pale except postclypeus black with pale margins; mouthparts and rear of head pale; antennae black, apices of first and second segments pale.

Prothorax: Front lobe pale bordered with black; middle lobe black dorsally, pale laterally, a dorsolateral pale spot present on each side and variable in size, a pair of prominent dorsolateral pits present near the caudal margin; hind lobe black with pale lateral margins, caudal margin convex and entire.

Pterothorax: Pale with black middorsal stripe occupying about half the mesepisternum and slightly narrowed posteriorly; black humeral stripe slightly narrower than pale antehumeral stripe, of about constant width throughout, but with a slight widening posterior to the mesinfraepisternum; first lateral stripe represented by a mere posterior vestige; metapleural suture covered by a thin second lateral stripe, which expands posteriorly into a spot; humeral and middorsal stripes connected posteriorly by the black of the antealar carina and sinus, which fades slightly laterad of the humeral stripe. Coxae and trochanters entirely pale. Femora and tibiae pale, each with a black external stripe for almost the entire length; tarsi pale, each with distal end of third segment dark; spines of legs black; claws pale with black tips.

Mesostigmal laminae: Widest in mesal half; a closed mesal concavity present, deepest posteriorly; the entire lateral half twisted and upturned at an angle of 60 degrees or more; most of lateral half pale; separated from the thoracic depression by a posterior groove for its lateral half only.

Wings: Venation black or dark brown; pterostigma light brown. M_2 arises between the 4th and 5th postnodal crossveins in the front wings, between the 3rd and 4th in the hind wings; postnodals 9-12 in front wings, 8-10 in hind wings; M_{1a} arises at about the level of the 8th postnodal in both wings.

Abdomen: Pale with black as follows: Segment one, a squared middorsal spot on basal half, a small apical spot

on each side; segment 2, entire dorsum, widened slightly toward apex, connected to a narrow apical ring; segments 3-7, entire dorsum, abruptly constricted basally, slightly widened anteapically, connected with a narrow apical ring; segment 8, entire dorsum, widened gradually from base to apex; segments 9 and 10, entire dorsum. Midventral sternal carinae black on 1-8. Anal appendages and valves and styli of ovipositor pale; apex of each valve of ovipositor, to base of stylus, extends not quite to apex of segment 10 excluding appendages. Ventral spine of segment 8 black to dark brown, sharp.

Figure 1. Left mesostigmal lamina of *Enallagma* females in dorsolateral aspect. A. *laterale*. B. *recurvatum*. C. *davisi*. D. *minusculum*. ca. 35x.

Measurements: Total length to apex of segment 10, excluding appendages: 24.8-28.0 mm.; length of abdomen: 20.0-22.7 mm.; length of front wing: 14.5-17.8 mm.; length of hind wing: 15.4-16.3 mm. The two Cape Cod specimens are larger; the Long Island specimen is represented by the smaller extreme in each case.

Described from two specimens captured in tandem with males by the writer at Jabinette's Pond, West Yarmouth, Massachusetts, on June 13, 1953, and one specimen from Riverhead, Long Island, New York, caught on May 29, 1953, by Mr. Roy Latham.

Enallagma recurvatum Davis. Female

Jour. N. Y. Ent. Soc. **21**: 15-16. 1913

Color: Olivaceous, washed with light blue, and black.

Head: Dorsum black; pale frontal margin not quite reaching bases of antennae; postocular spots comma-shaped, isolated from the light occipital carina, not quite reaching ocular margins; face pale except postclypeus black and pale lateral edges; mouthparts and rear of head pale; antennae black, apices of first and second segments pale.

Prothorax: Front lobe pale bordered with black; middle lobe black dorsally, pale laterally, a dorsolateral pale spot either present on each side and variable in size, or absent, and a pair of prominent dorsolateral pits present near the caudal margin; hind lobe black with pale lateral margins, caudal margin convex and entire.

Pterothorax: Pale with black middorsal stripe occupying slightly more than half the mesepisternum, somewhat narrowed posteriorly; humeral black stripe slightly wider than the pale antehumeral stripe, widened at the mesinfraepisternal suture, narrower on the mesinfraepisternum; first lateral stripe absent or a mere vestige; second lateral stripe a fine line on the metapleural suture, widened posteriorly into a spot; middorsal and humeral stripes connected posteriorly by the black of the antealar carina and sinus, which continues laterad to the region of the first lateral stripe. Coxae and trochanters entirely pale. Femora and tibiae pale, each with a wide black lateral stripe covering most of their lateral surface; tarsi pale, each with tip of third segment dark; spines of legs black; claws pale with black tips.

Mesostigmal laminae: Mesal edge at about a 30 degree angle to middorsal carina; mesal half much wider than lateral half; postero-mesal corner much thickened; a deep depression near mesal margin; anterior margin of lateral portion upturned; lateral end with a variable, usually small, light spot.

Wings: Venation black or dark brown; pterostigma light brown. M_2 arises between the 4th and 5th or 5th and 6th postnodal crossveins in the front wings, between the 3rd and 4th or 4th and 5th in hind wings; postnodals 9-11 in front wings, 8-10 in hind wings, the majority having

11 and 9; M_{1a} arises at about the level of the 7th to 9th postnodal crossvein in the front wings, about the 7th or 8th in the hind wings, the majority arising at the 8th in both wings.

Abdomen: Pale with black as follows: Segment one, a middorsal basal spot and a lateral apical transverse dash; segment 2, entire dorsum, constricted or narrower in anterior half, connected with an apical ring; segments 3-7, entire dorsum, abruptly constricted basally, slightly widened anteapically, connected with an apical ring; segment 8, a narrow middorsal line abruptly widened to cover apical dorsum; segments 9 and 10, entire dorsum. Midventral sternal carinae black on 1-8. Anal appendages and valves and styli of ovipositor pale; apex of each valve of ovipositor, to base of stylus, extends not quite to apex of segment 10 excluding appendages. Ventral spine of segment 8 black or dark brown, sharp.

Measurements: Total length to apex of segment 10, exclusive of appendages: 26.8-28.2 mm.; length of abdomen: 21.0-22.2 mm.; length of front wing: 16.1-18.0 mm.; length of hind wing: 14.7-16.9 mm. Taken from four Cape Cod specimens and one from Long Island. The Long Island specimen is represented in each measurement by the smaller extreme.

Described from 11 specimens from the following localities: Flax Pond, North Falmouth, Mass., June 17, 1951 (3), June 16, 1953 (5), and Jabinette's Pond, West Yarmouth, Mass., June 13, 1953 (1), all collected by the writer; and Riverhead, Long Island, New York, May 29, 1953 (1), June 2, 1953 (1), collected by Mr. Roy Latham.

Key to Females of Ten Species of *Enallagma* Based Principally on Mesostigmal Laminae

In the key which follows, the females of ten species of *Enallagma* are compared. These ten comprise those which might be confused for one reason or another, or which may be closely related to *laterale* or *recurvatum*. Relationships among the species of *Enallagma* are difficult to determine and, to date, have been largely based on the form

of the anal appendages of the male. It has been almost impossible to divide the females into logical groups. Mention of the males of the species being compared, then, may make clearer the reason for comparing their females.

Enallagma laterale would appear, from gross examination of the male genitalia, to be close to *E. piscinarium, E. davisi,* and *E. boreale,* and perhaps to *E. minusculum* (Westfall, 1943). In these species the superior anal appendage is shorter than segment 10 and ranges from bluntly rounded to deeply, but narrowly, cleft. *E. minusculum* is most like *davisi,* but the lower arm of the superior anal appendage of the former appears prominently circular in lateral view.

The male of *E. recurvatum* bears a superficial resemblance to *E. vernale,* but the latter species is believed by Mrs. Gloyd (1943) and by Walker (1953) to be more closely related to *cyathigerum.* The recurved superior anal appendages of *recurvatum* are somewhat similar to those of *E. hageni,* which, however, are straight as viewed laterally. Both *laterale* and *davisi* males are characterized by a lateral black mark on the eighth abdominal segment. Several *recurvatum* from Cape Cod also show this mark, although it is not commonly present.

The caudal lamellae of the nymphs of *E. ebrium* and *E. geminatum* resemble those of *laterale* (Howe, 1921), indicating possible relationship. The nymph of *recurvatum* is unknown, and that of *laterale* has never been adequately described.

The form of the mesostigmal laminae may prove to be indicative of relationships among the females of *Enallagma.* At any rate, the laminae are by far the best means for identifying the species. If Byers (1927) had possessed females of both *hageni* and *recurvatum,* he could have recognized them both immediately by a glance at the laminae. In the key this character will play a prominent part. For illustrations of the mesostigmal laminae of most of the keyed species, I recommend the beautiful plates in Walker (1953). Those of *laterale, recurvatum,* and *davisi* (from the allotype) are figured in the present paper, along with that of *minusculum.* The latter is in-

cluded because Walker's illustration is somewhat deceptive. The resemblance is obvious, but I have found the lateral ends bluntly pointed, not rounded, and the diagonal ridge which runs antero-laterally from the postero-mesal region is diagnostic.

1 — Lamina more than half as wide as long 2
— Lamina less than half as wide as long 3

2(1) Lamina widest mesally, gradually narrowing laterally for two-thirds of length, rapidly narrowing in lateral one-third to form an antero-lateral blunt point, postero-lateral edge not curled upward; dorsum of abdominal segment one entirely black, connected to an apical ring ..... *ebrium*
— Lamina widest about midway to lateral end, the postero-lateral edge curled upward, often extremely so, a blunt point formed antero-laterally; dorsum of segment one with a black basal spot and an apical spot on each side ..... *hageni*

3(1) Lamina with a mesal enclosed concavity formed by the high antero-mesal corner and the raised or thickened postero-mesal edge 4
— No such concavity present; edges may be curled to form a shallow basin or cavity may be formed by anterior corner and be open posteriorly 8

4(3) Postero-mesal margin of lamina tilted ..... *vernale*
— Postero-mesal margin of lamina not tilted, but may be thickened 5

5(4) Lamina twisted so that entire lateral half is greatly tilted 6
— Entire lateral half of lamina not up tilted; antero-lateral margin may be raised 7

6(5) Twisted lateral portion of lamina bent posteriorly; lamina well-demarcated from thorax by a posterior groove for its entire length; prothoracic pits absent; segment one with dorsum entirely black, connected to apical ring; black of segment 8 not narrowed; black of segments 9 and 10 extending far laterad ..... *minusculum*

— Twisted lateral portion of lamina not bent posteriorly; lamina definitely demarcated only in lateral half; prothoracic pits present; segment one with a black basal spot, lateral apical spots; segment 8 with black slightly narrowed anteriorly; black of segments 9 and 10 not extending much beyond a mid-lateral point ..... *laterale*

7(5) Mesal edge of lamina at about 30 degree angle to mid-dorsal carina; postero-mesal corner much more thickened than antero-mesal, posterior edge broadly curved in mesal half, mesal half much broader than lateral half; pit in frame rather wide; prothoracic pits present; black of segment 8 constricted in basal half, no lateral stripe present on 2 or 8 ..... *recurvatum*

— Mesal edge of lamina nearly parallel to mid-dorsal carina; antero-mesal corner more thickened than postero-mesal, posterior edge nearly straight, mesal half not greatly broader than lateral half; pit in frame rather small; prothoracic pits absent (sometimes a deceptive set of shallow areas present); a lateral black stripe present on segment 2; black of segment 8 narrow dorsally, a black lateral stripe present, the two black portions enclosing a blue spot on each side ..... *geminatum*

8(3) Lamina nearly flat except tilted antero-lateral margin; prothoracic pits present ..... *davisi*

— Lamina not flat; anterior open concavity present; prothoracic pits absent 9

9(8) Mesal edge of lamina at about a 30 degree angle to mid-dorsal carina; postero-mesal margin sharply delimited from the thorax by a groove ..... *cyathigerum*

— Mesal edge of lamina nearly parallel to mid-dorsal carina; postero-mesal margin not clearly demarcated from thorax ..... *boreale*

Literature Cited

Byers, C. Francis
1927. Key to the North American species of *Enallagma* with a description of a new species. Trans. Am. Ent. Soc. 53: 249-260.

Davis, William T.
1913. Dragonflies of the vicinity of New York City with a description of a new species. Jour. N. Y. Ent. Soc. 21: 11-29.

Garman, Philip
1927. Guide to the insects of Connecticut. Part V. The Odonata or dragonflies of Connecticut. State Geol. and Nat. Hist. Surv. Bull. 39. Pp. 331.

Gloyd, Leonora K.
1943. *Enallagma vernale,* a new species of Odonata from Michigan. Occ. Pap. Mus. Zool. Univ. Mich. 479: 1-8.

Howe, R. Heber, Jr.
1921. Manual of the Odonata of New England. Nymphs. Mem. Thoreau Mus. Nat. Hist. II: 103-115.

Morse, Albert P.
1895. New North American Odonata. II. Psyche 7: 274-275.

Walker, Edmund M.
1953. The Odonata of Canada and Alaska. Vol. I. Pp. xi + 292. Univ. Toronto Press.

Westfall, Minter J., Jr.
1943. *Enallagma davisi,* a new species from Florida. Ent. News 54: 103-108.

A NEW SPECIES OF ANT BELONGING TO THE *PHEIDOLE PILIFERA* COMPLEX (HYMENOPTERA: FORMICIDAE)

By Robert E. Gregg

Department of Biology, University of Colorado

A small collection of ants representing the genus *Pheidole* from several localities in Western United States was given to me recently by Dr. W. S. Creighton. Among these specimens are samples of several colonies from Oregon which prove to be a new species. The description of this ant follows herewith.

Pheidole creightoni sp. nov.

Soldier: Length, 3.75 mm.; head index, 0.94; head length, 1.33 mm.; thorax length, 1.00 mm.

Head subquadrate, slightly longer than broad, with prominent occipital corners and a deep occipital emargination leading to a pronounced cephalic sulcus. In profile, the occipital border is flat and slopes forward, but joins the vertex in a rounded though noticeable angle rather than through a continuous curve. Anterior clypeal border broadly emarginate in the center, the lateral borders nearly straight. Frontal carinae flat and slightly divergent. Frontal area well-defined and in the shape of an isosceles triangle. Eyes lateral and placed distinctly anterior to the middle of the head. Antennae 12-segmented, with a club composed of the last three articles; funicular segments 5 to 8, slightly longer than broad; antennal scape distinctly bent at the base, with only a faint indication of flattening, and with its distal portion definitely wider than the basal portion. The scape extends posteriorly a little less than one-half the distance from its insertion to the occipital corner of the head. Mandibles heavy, abruptly convex, and provided with two very blunt teeth at the apex; remainder of the cutting border entire.

Thorax convex, with well-marked humeral angles; promesonotum does not descend before reaching the

mesoëpinotal suture; suture deep but narrow; epinotal spines projecting upward and outward, blunt, about one-half as long as the distance separating their bases. Petiolar peduncle long, node narrow in the antero-posterior direction and shallowly emarginate on the crest. Postpetiole twice as wide as the petiole, lenticular in shape from above as a result of pronounced lateral conules which are convex anteriorly and concave posteriorly.

Abdomen elliptical and somewhat depressed; of the shape usually characteristic for the genus.

Sculpture: Pronounced transverse rugae on the occiput, extending into and across the cephalic furrow, but fading out on the vertex; finer, longitudinal rugae on the frons, anterior surfaces of the genae, and on the clypeus; interrugal striations and granules very fine, so that the sculptured areas of the head are shining; non-sculptured regions (vertex, gula, and frontal area) are exceedingly smooth and shining; mandibles striate and shining. Thorax glabrous and shining except the granular mesopleurae and epinotal pleurae; basal face of the epinotum between the spines for the most part smooth; mesoëpinotal suture cross-striate. Petiole and postpetiole finely granular, almost smooth. Gaster smooth and shining.

Pilosity: Head, thorax, petiole, postpetiole, gaster, legs, funiculi, and scapes covered with long, finely pointed hairs of varying length.

Color: Head yellowish red, mandibles brown, thorax brownish red, gaster dark brown, legs and antennae light brown.

Worker: Length, 2.08 mm.; head index, 0.86; head length, 0.58 mm.; thorax length, 0.67 mm.

Head subquadrate, occipital border slightly emarginate. Genae striate between eyes and mandibular insertions, otherwise smooth and shining. Thorax smooth and shining except mesopleurae and the dorsum and sides of the epinotum which are granular; interspinal space and declivity smooth. Petiole and postpetiole shagreened. Epinotal

---

Explanation of Plate 2

Pheidole creightoni, a. soldier; b. head of soldier; c. worker. All figures are drawn to the same scale.

a

b

c

GREGG — PHEIDOLE CREIGHTONI

TABLE I — S

Character	*Pheidole creightoni*	*Pheidole pilifera*	*Phei*
Cephalic sculpture	Heavy transverse occipital rugae; vertex smooth; frons longitudinally striated to finely rugulose; brightly shining	Coarse longitudinal striations or rugae cross whole length of head; become reticulate on occiput; opaque	Longitu on vert punctur shining ticulate
Body sculpture	Almost completely shining; thoracic sculpture only on mesopleurae and epinotal pleurae; gaster shining, smooth	Interrugal sculpture granulate; thorax, petiole, postpetiole opaque; gaster granulate, weakly shining	Opaque typical
Measurements	Length, 3.80 mm. Head index, 0.92 (average 10 individuals)	Length, 4.47 mm. Head index, 0.95 (average 10 individuals)	Length, Head i (1 indi
Humeral angles	Well-developed in most individuals	Prominent; marked by fine rugae	Well-de fine ru
Postpetiole	Conules prominent and sharp	Conules present but blunt	Conules *fera*
Clypeal notch	Well-marked; concave	Shallow and V-shaped	Very sl
Color	Head bright yellowish red; thorax brownish red; gaster dark brown	All reddish brown; frons and vertex slightly redder	Dark re

TAI

Body sculpture	Entire body brightly shining; only mesopleurae and epinotal pleurae slightly granular	Head granulate and finely longitudinally striate, opaque; thorax, petiole and postpetiole granulate; gaster shagreened but shining	Sculptu that of promes pleurae ing
Postpetiole	Postpetiole broad, twice as wide as petiole	Postpetiole broad, about 2¼ times as wide as petiole	Postpet

* Specimens not seen. The species is known only from types in the American Muse Natural History, the Museum of Comparative Zoology, and the collection of Creighton. Data were obtained from the literature and from Dr. Creighton.

R WORKERS)

Pheidole p. coloradensis	*Pheidole p. pacifica**	*Pheidole senex*
Strong longitudinal rugae ading out toward occiput; ntire head finely granu- ate; vertex and occiput vith coarse piligerous fo- reolae; opaque	Feeble transverse occipital striae, confined to the top of the occiput; vertex strongly shining	Longitudinal rugae on frons; transverse rugae on occiput converging to fur- row; interrugae granulate, subopaque; vertex smooth and shining
Thorax granulate; faint ir- regular rugae; opaque; gas- er shagreened but slightly hining	Dorsum of the pronotum smooth and shining, pleurae finely rugulose; epinotum, petiole and postpetiole punctate	Thorax opaque; pleural rugae longitudinal, dorsal rugae transverse to irregu- lar; petiole, postpetiole, gas- ter granulate
Length, 4.67 mm. Head index, 0.94	Length, 4.50 mm. Head index, 0.93	Length, 5.41 mm. Head index, 0.91
average 10 individuals)	(2 individuals)	(average 10 individuals)
Prominent	Prominent	Very prominent
Conules prominent and harp	Conules present but blunt	Conules decidedly promin- ent, sharp
Very shallow	Shallow and concave	Shallow and concave
Body dark reddish brown; ead and gaster somewhat ighter	Head yellowish red with a brown spot on vertex; tho- rax and gaster brown	Head brownish red; tho- rax dark brown; gaster light brown

ERS

Entire head, thorax, and petiole granulate; head also vith fine, longitudinal ru- ulae, opaque; postpetiole mooth dorsally; gaster hagreened	Head finely, longitudinally rugulose and punctate; sub- opaque	Very similar to *coloraden- sis* except postpetiole granu- late dorsally
Postpetiole narrow, 1½ imes as wide as petiole		

spines short and triangular, but sharp. Scapes reach to the occipital corners of the head. Gaster glabrous and shining. Color of entire body dark brown, legs and antennae light brown.

Female: Length, 5.25 mm.; head index, 1.0; head length, 1.10 mm.; thorax length, 1.58 mm.

Resembles soldier in most respects, but differs from that caste in the following ways. Body size larger, head quadrate, frontal area level with the general surface of the head (not depressed), compound eyes large and occupying a proportionately greater area on the sides of the head, vertex with three prominent ocelli, occipital lobes are not as pronounced and the furrow is shallower, scapes reach approximately half way from their insertions to the corners of the lobes, and the mandibular teeth are sharper and more distinct. Entire dorsal and lateral surfaces of the head covered with rugae which are longitudinal on the frons and genae, but curve to parallel the occipital lobes, bend centrally and become transverse on the occiput and in the furrow. Interrugal sculpture consists of fine striae, granules, and large dimples or foveae. Surface shining despite the sculpture but less so than in the soldier.

Thorax flat except where mesonotum descends abruptly to the pronotum; dorsum of pronotum, mesonotum, and metanotum shining and smooth except for piligerous punctures; propleurae and epinotal pleurae with parallel rugulose sculpture, subopaque; epinotal base rugulose, declivity smooth; epinotal spines short, conical, and half as long as their interbasal distance. Petiole and postpetiole like those of the soldier, opaque; lateral conules of the postpetiole very prominent and bluntly rounded at the tips. Gaster sharply truncate at the base, anterior margin straight. Wings transparent, stigma pale brown, one discal cell. Head and mandibles reddish brown, thorax darker, gaster dark brown, legs and antennae light brown.

Male: Length, 4.08 mm.; head index, 1.14; head length, 0.58 mm.; thorax length, 1.58 mm.

Explanation of Plate 3

Pheidole creightoni, a female (deälate); b. male; c. head of male. All figures are drawn to the same scale.

GREGG — PHEIDOLE CREIGHTONI

Head wider than long, obovate, anterior end broader. Compound eyes large and occupying fully half the sides of the head; three ocelli situated on prominent elevations of the vertex which cause the head to appear produced dorsally. Clypeus convex, anterior border entire. Mandibles small, narrow, with one apical tooth and two minute denticles. Frontal area broadly triangular. Antennae 13-segmented; scape short, equal to the combined length of the first two funicular segments; first funicular segment globular.

Thorax almost 1½ times as wide as the head. Mesonotum flat dorsally, scutellum convex; Mayrian furrows present except for the medial stem which is almost obsolete; parapsidal furrows or sutures absent; epinotum descends rapidly to the petiolar junction, epinotal spines absent. Petiolar node low and rounded, except for slight superior angles. Postpetiole broad and subquadrate, lateral conules very short and blunt. Gaster of the usual elliptical shape. Stipites convex, curved medially and bulbous at the apex; cerci minute and cylindrical.

Head coriaceous, sculpture consisting of fine striations and granules, subopaque. Thorax shining except for fine striae on the anterior vertical border of the mesonotum; entire metathorax and propodium finely granular, opaque. Petiole, postpetiole and gaster smooth and shining. Fine, pointed hairs cover all surfaces of the body and appendages except the scapes and funiculi. Head black, mandibles and antennae yellow, thorax, abdomen and legs brown. Wings transparent, stigma pale brown, one discal cell.

Holotype: soldier, located in the author's collection.

Paratypes: 219 soldiers, 379 workers, 4 females, and 40 males, deposited in the author's collection, and the collections of W. S. Creighton, the American Museum of Natural History, the Museum of Comparative Zoology, and the United States National Museum.

Type locality: Three miles east of Applegate, Oregon; elevation 1500 feet. This town is about 20 miles west of Medford, on the northern slope of the Siskiyou Mountains, in southwestern Oregon.

Material examined: The specimens upon which this

species is based represent nine separate colonies collected on July 24, August 12, August 16, September 18, and September 22, 1952. They were all secured by Dr. and Mrs. Creighton from the same place (type locality), and winged castes were present in the colonies obtained on August 12, September 18 and 22.[1]

Variation in type material: About one-third of the soldiers have the vertex very smooth and absolutely devoid of sculpture save for minute piligerous punctures, the remainder showing exceedingly fine striations confluent with the rugae on other parts of the head. This delicate sculpture, however, does not reduce the brilliant surface of the vertex in the specimens to hand. Soldier mandibles may have the two apical teeth absent or nearly so, and give the appearance of having been worn down by long continued use. One soldier showed vestiges of the two lateral ocelli, and one colony contained 15 soldiers in which the postpetiolar conules were so reduced as to be nearly absent. Worker scapes just reach the occipital corners or very slightly surpass them. There are elusive differences in color among the many specimens seen, some being slightly darker in over-all tone, but these fluctuations are regarded as inconsequential.

Affinities: This ant is closely related to members of the *pilifera* complex, and in fact runs out to this group in Creighton's recent key (1950), but fails to fit any of the forms treated. Perusal of the accompanying tables (Table I and Table II) will help to distinguish the new ant, *creightoni,* from its relatives for the important diagnostic features have been emphasized, especially of the soldier caste. Of these, it has been found that the most valuable characteristics for separating *creightoni* from other forms of the *pilifera* group are, (1) its small size (except for *artemisia*), (2) the nature and distribution of particularly

[1]Since this paper was submitted, Dr. A. C. Cole very kindly sent me a sample of *Ph. creightoni* containing four soldiers and numerous workers which he collected at Winnemucca, Nevada, elevation 4334 feet, on July 8, 1954 (Cole Collection # 212). The specimens appear in every way to be conspecific with the types of the new species, and this opinion has been confirmed both by Dr. Cole and by Dr. M. R. Smith.

the cephalic sculpture, together with the weakness of the interrugal sculpture which leaves the whole surface very shining, (3) the clypeal notch which is very well-developed, and (4) the color which is yellowish red in large part as compared to the reddish brown to brown color of the other species.

Dr. Creighton has also supplied pertinent field notes concerning the new species which give interesting information about the biology of this ant. The nests are populous and are surrounded by large amounts of chaff. Both workers and majors forage for food and move in files. The ants are not only granivorous but carnivorous as well, for the blood and tissues of purposely shot ground squirrels, placed nearby, were accepted as food. About eighteen colonies were seen altogether, and it is said that the nests are frequently excavated near those of *Veromessor andrei*. Males and females of *creightoni* emerge in small numbers (approximately two dozen) each day about one hour before sunset. The worker ants remain in the nest most of the day, but they become active in the late afternoon before the flight takes place. The marriage flights which were observed lasted from September 15 to September 21.

Literature Cited

Creighton, W. S.
1950. The ants of North America. Bull. Mus. Comp. Zool., **104**: 163.

SPECIES OF THE *AMATA* (*SYNTOMIS*) *PFEIFFERAE* GROUP (LEPIDOPTERA: CTENUCHIDAE)[1]

By Nicholas S. Obraztsov

Sea Cliff, New York

This paper deals with a small group of moths, closely related to *Amata* (*Syntomis*) *pfeifferae* (Moore) and occurring in Borneo, Sumatra and Java. For this study I have examined the collections of the Rijksmuseum van Natuurlijke Historie (Leiden, The Netherlands) and the Museum of Comparative Zoology at Harvard College. At first sight, the species of this group give the impression of being merely individual forms of a single species, and this similarity gave Hampson (1898) occasion to consider *Amata* (*Syntomis*) *acuminata* (Snell.) a synonym of *pfeifferae*. To avoid further misidentification, the present paper describes the most important characters of the three species already known and one new one.

The author acknowledges with thanks the cooperation of Dr. A. N. Diakonoff and Dr. P. J. Darlington, Jr., in placing the materials of the above-mentioned museums at his disposal and thanks to Dr. W. L. Brown, Jr., for reading the English text of the manuscript.

Amata (*Syntomis*) *pfeifferae* (Moore)

Fig. 1

Syntomis pfeifferae Moore (& Horrfield), 1859, Cat. Lep. Ins. East India House, Vol. 2, (1858-59), p. 324; Moore, 1859, Proc. Zool. Soc. London, p. 198, pl. 60, fig. 5; Walker, 1864, List Spec. Lep. Ins. B. M., pars 31, p. 64; Hampson, 1898, Cat. Lep. Phal., Vol. 1, p. 88; Snellen, 1904, Tijdschr. v. Ent., Vol. 47, p. 55; Zerny, 1912, Wagner's Lep. Cat., pars 7, p. 55; Seitz, 1913, Gross-Schm. Erde, Vol. 10, p. 78, pl. 11 f [figs. 4-5].

[1]Published with a grant from the Museum of Comparative Zoology at Harvard College.

Zygaena pfeifferae Kirby, 1892, Synon. Cat. Lep. Het., Vol. 1, p. 96.

The redescription of this species published by Hampson (1898) is quite accurate. The figures given by Moore (1859) and Seitz (1913) are exact except for the number of the yellow abdominal girdles. Actually, there are seven such girdles in the male, six in the female.

MALE GENITALIA (fig. 1): Uncus moderately thickened, not too long, slightly curved downward. Tegumen with short, equal lateral appendages. Valvae subtrapezoidal, the right one rather broader; processus basalis of the right valva curved caudad, that of the left valva directed upward. Aedoeagus moderately long, rather thick, with a row of small cornuti.

SPECIMENS EXAMINED: three males and two females, Java; one male, Tjampea, Java, 1892; one male, Tagal, Java; one female, Ardjouno, Neeb leg.; one female, Padang, Sumatra (Rijksmuseum van Natuurlijke Historie, Leiden).

Amata (*Syntomis*) *quadripunctata* Rothsch.
Fig. 2

Amata quadripunctata Rothschild, 1910, Novit. Zool., Vol. 17, p. 433; 1913, ibid., Vol. 19, (1912), p. 375, pl. 3, fig. 36; Hampson, 1914, Cat. Lep. Phal., Suppl., Vol. 1, p. 31.

Syntomis quadripunctata Zerny, 1912, Wagner's Lep. Cat., pars 7, p. 25; Seitz, 1913, Gross-Schm. Erde, Vol. 10, p. 78, pl. 11 k, [fig. 3].

The whole appearance of this moth, described as an independent species, is that of an aberration of *pfeifferae* with reduced spots. The single male specimen examined by the author is very like that of *quadripunctata* figured by Rothschild (1913) except for the forewing spots (especially m_3, m_5 and m_6) which are somewhat larger, and a distal spot occurring in the hind wing. The middle cell of the hind wing orange as in *pfeifferae*, and the specimen examined otherwise identical to *pfeifferae* in the markings of the head and body.

MALE GENITALIA (fig. 2): Uncus somewhat more slender and longer than in *pfeifferae*. The left lateral appendage

of the tegumen longer than the right one. The left valva narrow, with a rounded tip; the right valva broad, with an irregularly curved upper edge, an acute tip and a very undulate lower edge; processus basales as in *pfeifferae*, but the right one dilated at the base and the left one narrower.

SPECIMEN EXAMINED: one male, Telokbetong, Kali Anda, Sumatra, 1928 (Rijksmuseum van Natuurlijke Historie, Leiden).

Amata (*Syntomis*) *acuminata* (Snell.)
Fig. 3

Syntomis acuminata Snellen, 1881, Veth's Midden Sumatra, Vol. 4, pars 1, div. 2, p. 31, pl. 3, fig. 5; Van Eecke, 1920, Zool. Meded. Leiden, Vol. 5, p. 116.

Zygaena acuminata Kirby 1892, Synon. Cat. Lep. Het., Vol. 1, p. 96.

Syntomis pfeifferae (part.) Hampson, 1898, Cat. Lep. Phal., Vol. 1, p. 88; Snellen, 1904, Tijdschr. v. Ent., Vol. 47, p. 55; Zerny, 1912, Wagner's Lep. Cat., pars 7, p. 25.

Syntomis pfeifferae ab. *acuminata* Seitz 1913, Gross-Schm. Erde, Vol. 10, p. 78.

This species, relegated by Hampson (1898) to the synonymy of *pfeifferae*, was recognized by Van Eecke (1920) as independent, although this latter author did not publish any argument supporting his point of view. The following notes are based on an examination of the male holotype of *acuminata*.

The figure published by Snellen (1881) is excellent. The thorax of *acuminata* is not spotted by orange at the middle as in *pfeifferae*, the forewing has no supradorsal orange streak, and the spot m_3 is narrower and pointed above. In the hind wing there is only a broad basal spot with an external tooth joined to it (= rudiment of a distal spot), but not two spots. Abdomen with six yellow abdominal girdles; Snellen described the female as having five such girdles.

MALE GENITALIA (fig. 3): Uncus broad at the base, narrowed at the tip. The lateral appendages of the tegumen rather long, longer and narrower than in *pfeifferae*. The

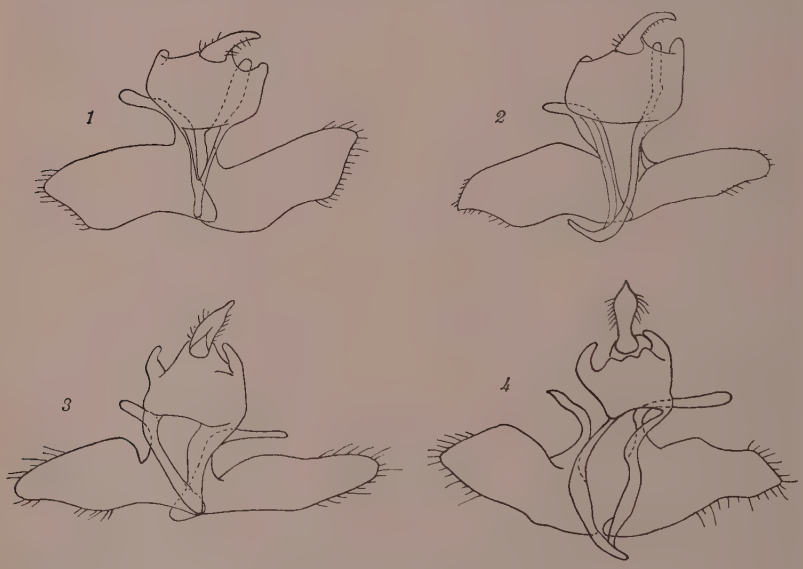
left valva narrow, the right one lancet-shaped. Processus basales of both valvae shorter, the left one directed caudad but not upward as in *pfeifferae*. The right valva deeply excavate before the processus basalis.

SPECIMEN EXAMINED: male, holotype, Bedar Alam, Sumatra, December 10, 1877 (Rijksmuseum van Natuurlijke Historie, Leiden).

Amata (Syntomis) borneogena, new species

Fig. 4

MALE: Antennae simple, black, white at tips. Head black, frons yellow; palpi brown. Patagia orange; tegulae black, orange-edged. Thorax (damaged!) with orange scales at the middle and posterior edge; pectus with two orange patches on each side. Abdomen black; first tergite



Text-figures 1 to 4. Anterior view of the spread male genitalia: 1—*Amata* (*Syntomis*) *pfeifferae* (Moore), Java (Rijksmuseum, preparation No. Ct. 7); 2—*A.* (*S.*) *quadripunctata* Rothsch., Telokbetong, Sumatra (Rijksmuseum, prep. No. Ct. 10); 3—*A.* (*S.*) *acuminata* (Snell.), holotype, Bedar Alam, Sumatra (Rijksmuseum, prep. No. Ct. 8); 4—*A.* (*S.*) *borneogena,* new species, holotype, Lundu Mt., Borneo (Mus. Comp. Zool., prep. No. 3, Obr.).

orange, third and fourth tergites with præsegmental girdles of the same coloring, fifth tergite entirely orange; the corresponding sternites with somewhat paler, almost yellow girdles; second sternite with yellowish scaling on the whole surface. Legs brown, only the bases of the interior side of the coxae yellow. Wings black-brown, shot with dark violet; spots orange. Length of the forewing: 14 mm.

Forewing with six spots: one subtrapezoidal spot (m_1) at the wing base supradorsad; a subquadrate spot (m_2) at the end of the middle cell; a larger, rhomboidal spot (m_3) below it; an elongate-ovoid spot (m_4) between the veins R_5 and M_1 near their base; the spots (m_5 and m_6) on both sides of the vein M_3 form a common roundish spot divided by the diffusely black-scaled vein. Hind wing with a basal spot stretching band-like from costa to dorsum; this band reaches about to the middle of the wing (in the middle cell about to its middle) and joins the distal spot which looks like an exterior tooth of the basal spot and occupies the small area below the middle cell and between the veins Cu_1 and Cu_2. The lower vein of the middle cell black-scaled; a diffuse blackish dot in the orange spot, below the middle cell and separate from it.

MALE GENITALIA (fig. 4): Uncus swollen before the pointed tip. Tegumen with the two large lateral appendages curved inward. The left valva with an undulate upper edge, a separate and angled apical part, the right one subtrapezoidal, shorter and much broader; both processus basales curved caudad, the left one much longer.

TYPE: male, holotype, Lundu Mt., Kuching, Sarawak, Borneo, July 15, 1920, H. W. Smith leg. (Museum of Comparative Zoology).

From all known species of the *pfeifferae* group, *borneogena* differs in number of abdominal girdles, and also in genitalia. The forewing spots m_1 and m_3 of the new species are more widely separated than in *pfeifferae*, and the orange supradorsal streak is absent. The hind wing spots of *borneogena* are like those of *acuminata*, but not like those of *pfeifferae*, which latter has two distinct spots. The truncate tooth formed by the distal spot of the hind wing of *borneogena* differs from the more acute tooth in

acuminata, and the forewing spots m_1, m_2 and m_4 of the new species are shorter. From *quadripunctata* the new species differs in having all wing spots better developed.

BREPHIDIUM BARBOURI CLENCH A SYNONYM OF BREPHIDIUM EXILIS ISOPHTHALMA (HERRICH-SCHAFFER) (LEPIDOPTERA: LYCAENIDAE).

Lycaena isophthalma Herrich-Schaffer, 1862, Corresp.-Blatt. zool.-min. Ver. Regensburg, 16:141, sex not stated. Type locality: Cuba.

Brephidium barbouri Clench, "1942" [1943] Psyche, 49:58, two males. Type locality: Great Inagua Island, Bahamas. NEW SYNONYMY.

An examination of the holotype and paratype males of *Brephidium barbouri* reveals that they are identical with *isophthalma* for the following reasons. In the first place, microscopic examination of the anal angle of the forewing fringe reveals that the white patch supposedly differentiating *isophthalma* from the dark fringed *barbouri* can be present in all intergradient degrees. One specimen of *isophthalma* examined had a well defined white patch on one wing and practically none on the other. Secondly, *barbouri* is supposedly darker both above and below than *isophthalma*. This appears to be the case if one compares the types of *barbouri* with the Nassau specimens of *isophthalma* in the Museum of Comparative Zoology, and apparently this is what Clench did. However, the Nassau specimens were collected in 1897, while the types of *barbouri* were collected in 1934. Therefore it seems quite likely that the difference in color is merely due to fading. Lastly, my comparison of the genitalia of the types of *barbouri* with those of *isophthalma* failed to reveal any differences in structure. — NICHOLAS W. GILLHAM, Harvard University, Cambridge.

TYLOTHRIPS BRUESI, A NEW THYSANOPTERON FROM FLORIDA

By J. Douglas Hood

Cornell University

The following species was taken within a few miles of Professor Charles T. Brues' home on the St. Johns River, in Florida, shortly after we had collected together and renewed an acquaintance which apparently began very nearly fifty years ago, long before he became Professor of Entomology at Harvard University and Editor of Psyche.

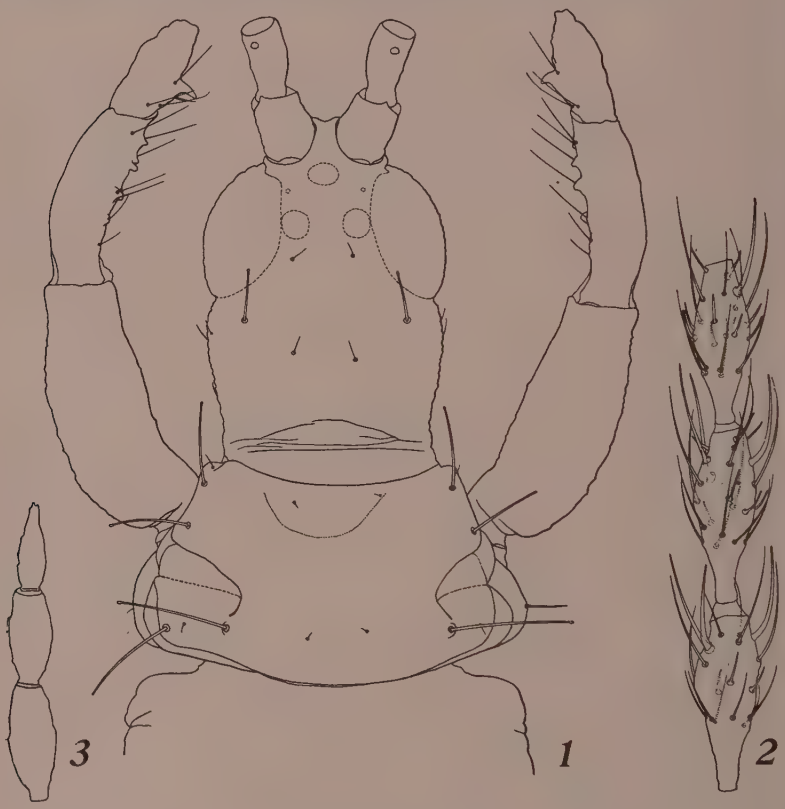
Tylothrips bruesi, sp. nov.

Text-figures 1 to 3.

Like the Peruvian *concolor* Hood, the type of the genus and only known congener, in coloration and most structural features, but (1) head about 1.4 (instead of scarcely 1.2) times as long as width across eyes, (2) last two antennal segments much narrowed basally, thus not forming with segment VI a terminal club, (3) segment III of antennae longer (instead of much shorter) than IV, and with several of its more apical setae as long as the neighboring sense-cones, (4) fore tibiae, only (instead of all three pairs), tuberculate along inner surface, (5) tube fully 2.3 (instead of less than twice) as long as its greatest subbasal width, and (6) major setae dull, or blunt, or very slightly dilated at tip (rather than broadly expanded).

♀ (macropterous). — *Color* of entire body, legs, and antennae blackish brown, with pedicel of antennal segment III and tip of tube somewhat paler and yellowish, IV-VI narrowly whitish just beyond the dark extreme base; internal pigmentation bright crimson-red, abundant in thorax and abdomen (exclusive of tube), sparse in head and first antennal segment; fore wings brown, darkest in anal area and with a dark median streak, which is narrowly edged with paler, extending to tip, the posterior margin pale between anal area and first fringing hair;

major setae pale and yellowish, excepting the wing-retaining setae and the terminal ones, which are brown.



Text-figures 1 to 3.

Tylothrips bruesi, sp. nov., ♀, holotype. Fig. 1.—Head and prothorax, x 176. (All setae omitted from femora, antennal segments, and outer surfaces of tibiae and tarsi; sculpture largely omitted; slight inaccuracies are to be expected in such details as the outlines of ocelli and of inner margins of eyes, because of the opacity of the specimen. It will be noted that the type lacks the right epimeral and left coxal setae.) Fig. 2.—Segments III-V, left antenna, x 236 (all setae shown). Fig. 3.—Segments VI-VIII, right antenna, x 236 (all setae omitted).

The cost of the line engraving was borne by Cornell University through its Committee on Faculty Research Grants.

Head (Fig. 1) slightly produced between eyes and antennae, fully 1.4 times as long as greatest width across eyes, this width somewhat greater than that across cheeks slightly behind eyes; sides of head incised at posterior margin of eyes; cheeks rounded and converging to near base, where the least width is about 0.86 the width across eyes, serrate as seen from above because of rather heavy anastomosing lines; frontal costa with a shallow rounded groove; postocular setae approximately 45 microns long, 121 microns apart, slightly dilated at tip. *Eyes* prominent, large, protruding, slightly less than one-half the length of head, their dorsal length 106 microns. *Median ocellus* with front margin on line with that of eyes. *Antennae* long and slender, about 2.24 times the length of head, their last three segments (Fig. 3) not at all united, the pedicels of VII and VIII not broad; III somewhat longer than either IV or V (Fig. 2), with several very fine, indistinct, transverse lines of sculpture on pedicel; major sense-cones long and slender, disposed as follows on inner (and outer) surfaces of segments: III 1(2), IV 1(2), V 1(1), VI 1(1), VII 1 dorsal; III and IV with several additional minor sense-cones; major antennal setae long and pointed, those associated with the major sense-cones about equal to them in length. *Mouth-cone* short, nearly semicircularly rounded at tip, extending about 70 microns beyond posterior dorsal margin of head.

Prothorax (Fig. 1), along median line of pronotum, about 0.63 the length of head and one-half the width across fore coxae, its surface nearly smooth but with a few faint lines of sculpture near posterior margin; posterior half of epimera fused with pronotum; antero-marginal setae very minute, the other usual setae long, moderately heavy, and very slightly widened at tip, the antero-angulars and midlaterals about 73 microns, epimerals and postero-marginals 87-91, coxals about 33. *Pterothorax* rather long, wider than prothorax across coxae; metanotal plate in basal half, shield-shaped and roundly elevated, its posterior part without distinct foveae at sides, the single pair of major setae pointed, 43 microns long and 78 microns apart. *Legs* moderately long and slender, the fore tibiae (Fig. 1) with several strong tubercles from each of which arises a

long pointed seta, mid and hind tibiae without much tubercles; fore tarsi with a strong and somewhat recurved tooth on inner surface. *Fore wings* straight, narrowed slightly and evenly to tip, not closely fringed, without accessory setae on posterior margin, the subbasal setae blunt (asymmetrically disposed in type).

Abdomen without distinct sculpture; major setae mostly slightly broadened at tip (excepting the wing-retaining ones, seta III on IX, and the terminal ones, all of which are pointed), I on IX 103 microns, II 132, III 109, terminal 120; tube (X, only) about 0.7 the length of head and fully 2.3 times as long as greatest subbasal width, its sides slightly concave beyond base, then straightly converging to tip.

Measurements of ♀ (holotype), in mm.: Length about 1.9 (fully distended, 2.43); head, total length 0.258, width across eyes 0.182, least width behind eyes 0.164, greatest width across cheeks 0.179, least width near base 0.158, width in front of eyes 0.093; pronotum, median length 0.154; prothorax, width across fore coxae 0.304; mesothorax, width across anterior angles 0.305; metathorax, greatest width 0.325; fore wings, length 0.962, width at middle 0.061; abdomen, greatest width (at segment IV) 0.354; tube (segment X, only), length 0.178, greatest subbasal width 0.077, width at apex 0.041.

Antennal segments:	I	II	III	IV	V	VI	VII	VIII
Length (microns):	49	63	101	97	93	68	54	53
Width (microns):	44	30	36	36	32	27	25	17

Total length of antennae, 0.578 mm.

FLORIDA: Welaka (Conservation Reserve, University of Florida), August 12, 1954, J. D. H., 1 ♀ (holotype), from dead fallen branches of Turkey Oak (*Quercus laevis*), in open sandy woods.

This is the second species of the genus *Tylothrips*, which the writer erected in 1937 for a Peruvian species that came from dead branches and leaves. The two are almost identical in color and general appearance and could easily be confused with each other.

AN EOCENE BITTACUS (MECOPTERA)[1]

By F. M. Carpenter

Harvard University

In 1928[2] I described, as *Palaeobittacus eocenicus,* a species of the family Bittacidae from Eocene strata in Colorado. This has been the only representative of the Mecoptera in Eocene deposits and the earliest unquestionable record of a living family of the order. A second Eocene bittacid has now turned up, this time among an extensive collection of insects which Dr. Carl Parsons and I made nearly twenty years ago in Utah. It appears to be a true Bittacus with characteristic wing venation and body features.

Genus *Bittacus* Latr.

Bittacus egestionis, n. sp.
(Figures 1 and 2)

Fore wing: 8 mm. long; maximum width, 2 mm.; antennae 2 mm. long; body 7 mm. long; wings without mark-

Figure 1. Drawing of fore wing of *Bittacus egestionis,* n. sp.

ings; venation and wing form as shown in figure 2; cubital cross-vein below the first fork of M; two pterostigmal cross-veins apparently present; hing wings somewhat more slender than fore wings.

[1]Published with a grant from the Museum of Comparative Zoology at Harvard College.

[2]A Scorpion-fly from the Green River Eocene. Annals Carnegie Museum, 28: 240-249. 1928.

Holotype: Museum of Comparative Zoology, No. 4921; collected by F. M. Carpenter and C. T. Parsons in the Evacuation Creek Formation, Green River Shales, about ten miles west of Evacuation Creek and the town of Watson, Utah. The fossil is very well preserved, showing antennae, legs, and all four wings; one pair of wings (fore and hind) rest together along the abdomen, but the other two extend below the body and are separated. The bases of the wings are partially concealed by the body of the insect and the veins there are not clearly preserved. The absence of copuloli and paraprocts shows that the specimen is a female.

Figure 2. Photograph of *Bittacus egestionis,* n. sp., from the Eocene of Utah. Length of fore wing, 8 mm.

Aside from generic differences this species differs from *P. eocenicus* by its more robust facies and smaller size. Its venation is typical of that of Bittacus, but the species is smaller than any other known in the family, so far as I am aware. In my account of the Baltic amber Mecoptera[3], I pointed out that one of the amber species, *Bittacus*

minimus, with a fore wing length of 11.5 mm., was the smallest bittacid known; *egestionis*, with a fore wing 8 mm. long, is even smaller. However, the other amber bittacids, as well as *Palaeobittacus*, show that not all of the early Tertiary Bittacidae were small; the range in size of these fossils is more an indication of the extent of the diversity of the family during Tertiary times.

[3]The Baltic Amber Mecoptera. Psyche, **61**: 31-40. 1954.

THE SOUTHWESTERN RESEARCH STATION OF THE AMERICAN MUSEUM OF NATURAL HISTORY — The American Museum of Natural History has announced the establishment of The Southwestern Research Station. It is located on the eastern slope of the Chiricahua Mountains, near Portal, Cochise County, in southeastern Arizona. The property is within the limits of the Coronado National Forest at an elevation of 5400 feet.

The station was established for the purpose of making available research facilities for scientists and students in all branches of science, who have problems that can be investigated through the utilization of the faunal, floral and geological features of the area. It will be open during the entire year.

It is operated by the American Museum of Natural History, Central Park West at 79th Street, New York 24, New York and under the direction of Dr. Mont A. Cazier, Chairman and Curator of the Department of Insects and Spiders, to whom all inquiries should be addressed. Anyone interested in the station should write to the above named individual for the booklet which gives the details of the operation and a general description of the area.

AN ODONATE FOSSIL WING FROM THE OLIGOCENE OF OREGON[1]

By Lt. Col. F. C. Fraser, I.M.S., Retd.

Bournemouth, England

I am indebted to Professor Frank M. Carpenter for generously delegating to me the task of describing an interesting odonate wing from the Eugene Formation of the the middle Oligocene of Oregon. The specimen was collected by Mr. Chester W. Washburne in 1900 and is one of the insects mentioned by Washburne in his account of the geology of the Eugene Formation.[2]

The specimen, which consists of a complete fore wing, is contained in a tuffaceous mudstone, a medium which makes for wonderful preservation of even the most minute details of venation; only the middle third of the space between the nodus and the pterostigma is damaged but this is just the part which is of the least importance and which can be restored with a minimum of error. The actual outlines of the wing are so intact that both the length and breadth can be given with the greatest accuracy. The wing belongs to a species of the family Epallagidae and with a few adjustments, might well be placed in the genus *Euphaea* Selys. The fossil, which consists of obverse and reverse impressions, is deeply stained a dull warm brown, agreeing in this respect with fragments of leaves and plants among which the wing had come to rest; thus I am of the opinion that this apparent pigmentation is only the result of staining or some later chemical reaction. This opinion is supported by a broad apical dark band which is present on the reverse impression but absent on the obverse; on the latter a convex crack runs across the apex of the wing and a tracing made of this served to show that

[1]Published with a grant from the Museum of Comparative Zoology at Harvard College.

[2]Reconnaissance of the Geology and Oil Prospects of Northwestern Oregon, 1914, Bull. U. S. Geol. Surv., 590:100.

it corresponded exactly with the curved outline of the dark apical band.

Order ODONATA, Suborder Zygoptera
Family Epallagidae
Genus **Litheuphaea** nov.

Venational characters of the wing similar to those of genus *Euphaea* Selys, differing only as follows: Nodus situated rather more basally (although the level of this differs within limits in both subgenera and species of *Euphaea;* the present specimen conforms in this respect most closely to *Anisophaea* Fraser); pterostigma much larger than in any recent species of *Euphaea,* very acute proximally, as in many species of the Megapodagriidae, and fusiform in shape, followed by two rows of cells distally

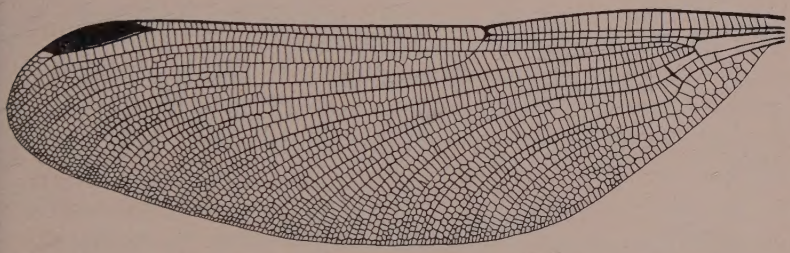


Fig. 1. Drawing of fore wing of *Litheuphaea carpenteri* n. sp.

between the costa and radius; discoidal cell entire and very short in view of the length of the wing; anal-vein, 1A, extending beyond the level of nodus; anal field immediately posterior to the discoidal cell made up of three rows of cells (only a single row at this level in *Euphaea*), the rows of cells separated by an irregular zigzagged vein which is evidently a vestigial recurrent anal-vein (absent or entirely vestigial in *Euphaea* but becoming strongly developed in the more recent Agriidae. (In this respect, the new genus establishes a link between the Epallagidae and Agriidae.) Other characters are as follows: Antenodals numerous and with their costal and subcostal portions in strict alignment; Rii not approximated nor confluent with the radius at its origin; Riii in continuation with the subnodus; longitudinal veins rather flat and not curved abrupt-

ly towards the wing border near their terminations, excepting CuP which is strongly convex and 1A which is markedly sinuous; four or more cubital cross-veins, two of which traverse the subdiscoidal cell and one of which forms its base. Medio-anal link very strongly developed and a conspicuous feature of the wing.

Type species of the genus, *Litheuphaea carpenteri* sp. nov.

Litheuphaea carpenteri sp. nov.

Fig. 1

Fore wing 34 mm in length; nodus situated 12 mm from base of wing; greatest breadth of wing 10.5 mm at level of distal end of anal vein. Pterostigma 5.15 mm. Antenodals 37; postnodals 50 ca. Two rows of cells between Rii and Riii beginning quite near the subnodus; intercalaries numerous; reticulation close. Anal vein highly convex and with a maximum of nine rows of cells between it and the border of wing; 2A strongly developed distal to the anal-link.

Above the impression of the wing, at about the central point of the antenodal portion of the wing, is to be seen a deep impression, in the bottom of which, in the obverse impression is the distinct outline of the lower jaw, so that it is evident that the impression represents the head of the insect upside down. The formation of the jaw is entirely similar to that of *Euphaea* with the median fissure as deep as half or more of the jaw and the palps of the same length and rounded outwardly. The impression of the rest of the head is to be seen only vaguely.

This species agrees with *Epallage* by the entire discoidal cell; with *Euphaea* by the position of the nodus, whilst the development of the anal field proximal to the level of the anal-link is found only in the recent *Dysphaea gloriosa* Fraser from Laos (Siam).

Holotype: Museum of Comparative Zoology, No. 4895ab, from the Eugene Formation (middle Oligocene), 3 miles north of Goshen, Oregon, collected by C. W. Washburne.

CAMBRIDGE ENTOMOLOGICAL CLUB

A regular meeting of the Club is held on the second Tuesday of each month (July, August and September, excepted) at 8:00 p.m. in Room B-455, Biological Laboratories, Divinity Ave., Cambridge. Entomologists visiting Boston are cordially invited to attend.

BACK VOLUMES OF PSYCHE

The Cambridge Entomological Club is able to offer for sale the following volumes of Psyche. Those not mentioned are entirely out of print.

Volumes 3, 4, 5, 6, 7, 8, each covering a period of three years, $5.00 each.

Volumes 10, 12, 14, 17, each covering a single year, $1.00 each.

Volumes 18 to 26, each covering a single year, $1.50 each.

Volumes 27 to 53, each covering a single year, $2.00.

Volumes 54 to 61, each covering a single year, $3.00.

Orders for 2 or more volumes subject to a discount of 10%.

Orders for 10 or more volumes subject to a discount of 20%.

All orders should be addressed to

F. M. CARPENTER, Editor of Psyche,
Biological Laboratories,
Harvard University,
Cambridge, Mass.

FOR SALE

CLASSIFICATION OF INSECTS, by C. T. Brues, A. L. Melander and F. M. Carpenter. Published in March, 1954, as volume 108 of the Bulletin of the Museum of Comparative Zoology, with 917 pages and 1219 figures. It consists of keys to the living and extinct families of insects, and to the living families of other terrestrial arthropods; and includes 270 pages of bibliographic references and an index of 76 pages. Price $9.00 (cloth bound and postpaid). Send orders to Museum of Comparative Zoology, Harvard College, Cambridge 38, Mass.